Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

Table No. 23.

PROF. J. O. STILLSON, M. D., College of Physicians and Surgeons, INDIANAPOLIS, IND.

1st Hour—General work.
2d " Mounting insects.

Table No. 24.

GEORGE C. TAYLOR, "Grey-Beard," - - - - THIBODEAUX, LA.

The working of Taylor's Diaphragm Lamp.

Table No. 25.

CHAS. SHEPARD, M. D., - - - - GRAND RAPIDS, MICH.

1st Hour—Dr. Shepard's cells for mineral mounts.
2d " Mounting mineral specimens.

Table No. 26.

MR. AND MRS. CHAS. WELLINGTON, - - - JACKSON, MICH.

1st Hour—General preparatory work.
2d " Mounting sponge spicules, etc., in glycerine.

Table No. 27.

W. S. WHITE, ESQ., Photographer, - - - - KALAMAZOO, MICH.

1st Hour—Making Griffith cells.
2d " Transferring micro-photographs from charms to slides.

Table No. 28.

JAS. E. WHITNEY, ESQ., - - - - - - ROCHESTER, N. Y.

1st Hour—Cell making and general preparatory work.
2d " Rapid method of mounting opaque objects.

SERIAL SECTIONS.

S. H. GAGE, B. S., Ithaca, N. Y.

For the investigation and understanding of embryological and histological facts, only next in importance to the proper hardening of the specimens, is the method of serial sectioning and mounting; for the parts may then be compared in the sequence occupied in the animal or part, and the most delicate or loosely connected parts are preserved *in situ*. One of the most satisfactory methods of procedure is to remove completely all the water from a specimen, after it has been properly hardened, by using 95 per cent. or stronger alcohol, and then to immerse it in chloroform two or three hours, or preferably over night. In this way the alcohol is replaced by chloroform, when the tissue should be placed in a mixture of imbedding mass 3 parts and chloroform 1 part (Note 1).

This is kept at the melting point, and the tissue should remain in it a day or two, or longer if desired. It is transferred from this to the just melted imbedding mass and kept in it for two hours or more. The longer the tissue remains the more certain is its complete infiltration. The time necessary depends also upon the nature and amount of the tissue (Note 2). (A good imbedding mixture where a section-flattener [Note 3] is to be used, is hardest paraffine 6 parts, vaseline 1 part.) When the object is properly infiltrated it is imbedded either in a paper or metal box or preferably in a well of the microtome.

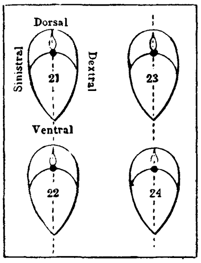
Wherever the embryo or tissue is imbedded it is desirable to have it is so arranged that its aspects will be known with certainty (Note 4). The method employed by the writer is to arrange every part as it is taken from the animal so that its aspects with reference to the whole animal are known. For example, if the œsophagus is removed for sections it is immediately pinned to a cork, the cephalad (anterior) end of the œsophagus being put toward a marked end of the cork, and the ventral aspect next the cork. It is pinned to the cork so that it may remain straight. Whatever manner the tissue is arranged is stated on its label, which goes with it through all the operations till it is finally cut and mounted. The sections are made in one of the three principal planes of the body :

(1.) The object is cut in a plane at right angles to the long axis of the body, in which case they are called transverse sections, or more shortly, transections (fig. 1).

(2.) Sections made parallel with the long axis of the body and passing from right to left. Such sections are called dextro-sinistral longisections, and are bilaterally symmetrical (fig. 2).

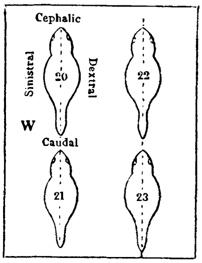
(3.) The sections are cut in a plane parallel with the long axis, and passing from the dorsal to the ventral aspect of the body. Such sections are called dorso-ventral longisections. If such a section were to pass through the middle of the body, that is, conincide with the meson, it would divide the body into a right and left half (fig. 3).

(1.) *Transections.*—When an embryo or tissue is embedded for transections, the caudal or tail end is placed up and the dorsal aspect or back toward some fixed part of the microscope. A tissue or animal being imbedded, as described above, it may be cut at any future time, for when the tissue is infiltrated with the imbedding mass there is no danger of its deterioration. Whenever the sections are to be cut the top of the imbedding mass is shaved off till the tissue is uncovered (Notes 5 and 6). The position of the microtome screw is carefully noted either by means of a special indicator or by a scale of some kind. As the sections are cut they are placèd on a prepared slide (Note 7) with their dorsal edge toward the top of the slide (fig. 1) as the caudal aspect of the sections is up, all the parts of the sections will correspond as to right and left with the right and left of the observer (fig. 1).



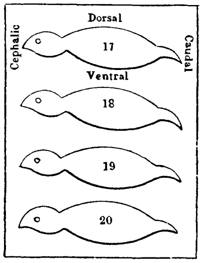
No $\frac{5}{3}$ Aug. 21, '84. C. 25 mm.
Transections of Necturns.
Sections No. 21-24. Mic. screw 25-24 mm.

Fig. 1



No. $\frac{15}{5}$ Aug. 21, '84. C. .35 μ
Dextro-sinistral longisections of Necturus.
Sections No. 20-23 Mic. screw 35-34 mm.

Fig. 2



No. $\frac{18}{4}$ Aug. 21, '84 C. .25.mm.
Dorso.ventral longisections of Necturus.
Sections No. 17-21. Mic. screw 26-25 mm.

Fig. 3

(2.) *Dextro-sinistral Longisections.*—The object is imbedded with the dorsal aspect up and the cephalad aspect toward some fixed part of the microtome; then when the sections are to be made, the imbedding mass is removed till the object is uncovered and the position of the microtome screw is noted. As the sections are cut they are placed on a prepared slide, so that the cephalic end points toward the top of the slide. As the dorsal side is up, the right and left of the sections will correspond with the right and left of the observer (fig. 2).

(3.) *Dorso-ventral Longisections.*—The object is imbedded so that the left or sinistral aspect is up and the cephalad end points toward some fixed part of the microtome. The object is uncovered and the position of the microtome screw is noted as above. As the sections are cut they are placed on the prepared slide with their dorsal edge toward the top of the slide and their cephalic extremity toward the left side of the slide (fig. 3).

PREPARATION OF THE SLIDES.

In order that the sections may remain in place on the slide during the operations of washing, staining and mounting, a substance must be employed to stick the sections to the slide, which will not injure the sections, and which is not affected by the liquids used in washing and staining. Such a substance is Schallibäum's clove oil collodion. It is prepared as follows:

Gun-cotton (that used by photographers)	$2^{\text{gr.}}$
Sulphuric ether	$15^{\text{cc.}}$
95 per cent. alcohol	$10^{\text{cc.}}$
Clove oil	$100^{\text{cc.}}$

The gun-cotton is first dissolved in the ether and alcohol, then the clove oil is added and the mixture filtered. To prepare a slide, the part on which the sections are to be placed is coated with the clove oil collodion by means of a quill duster. The slides should not be prepared until one is ready to use them. (Note 8.)

STAINING THE SECTIONS.

In order to stain the sections the imbedding mass must be removed. This is done as follows: When the slide is filled with sections (fig. 1) it is placed in an oven heated to 35–40 c. for 5–15 minutes to drive off the ether, alcohol and clove oil of the collodion. This end may also be attained by heating the slide directly over the alcohol lamp for two or three minutes, taking care not to heat too hot. To avoid this the slide should be frequently drawn across the palm of the hand. If the slide does not burn the hand the heat will not hurt the sections. After the clove oil, etc., have been driven off, the slide is immersed in a jar of some solvent of the imbedding mass (chloroform, xylol, benzine, naphtha, turpentine); chloroform and xylol being but very slightly inflammable are safer, although they are not superior as solvents to benzine or naphtha.

The imbedding mass is usually dissolved out in 15–20 minutes. The solution is hastened by moving the slide in the solvent or by pouring that over the sections. It does no harm to leave the slide in the solvent for several hours. After the imbedding mass is dissolved out of the sections they are no longer protected from desiccation, and hence would dry up if exposed to the air for any length of time. The slide is transferred from the solvent to a jar of 95 per cent. alcohol to rinse away the solvent (xylol or other agent). It is then ready to be stained with any desirable staining material. If the staining agent contains 50 per cent. or more alcohol, it may be put directly upon the sections after their removal from the jar of alcohol, but if the staining material is in aqueous solution the sections should be rinsed by pouring water over them before the stainer is applied. The sections may seem to be greasy when the water is poured upon them, but if they are treated according to directions the stainer will act without difficulty. If a rapid stainer is used, that is, one that will stain in 2–15 minutes, the best way is to lay the slide horizontally and put a drop of stainer on each section. If a long time is required to finish the staining, the slide should be placed in a jar of the staining agent.

MOUNTING THE SECTIONS.

Whenever the sections are sufficiently stained, the stainer is poured off and the sections are rinsed, first in water if a stainer in aqueous solution was used, then in alcohol. They are rinsed in 95 per cent. alcohol in the beginning, if an alcoholic solution of the stainer was used. After remaining in a jar of 95 per cent. alcohol for 5–10 minutes or longer, the slide is removed from the alcohol, drained for a moment, and then flooded with the clearing agent (turpentine 3 parts, carbolic acid 2 parts); the clearer acts sufficiently in a minute or two. After the clearing agent has been poured off, the sections are covered with a cover-glass which has been thinly coated with clove-oil-chloroform balsam prepared as follows: Pure Canada balsam $25^{gr.}$; chloroform $2^{cc.}$; clove oil $2^{cc.}$. The clove oil removes any cloudiness that may have appeared in the sections during the staining and rinsing. The cover-glass may be sealed at any time by putting on first a ring of liquid gelatine, and after this is dry several coatings of shellac cement. After the shellac is dry, any desired cement may be added as a final coating, although the shellac is sufficient.

LABELING.

The label should contain the following information: 1. The number of the preparation as the numerator of a common fraction and the number of the slide in the series as the denominator (see figs. 1–3); the date, and if possible, the thickness of the cover-glass. 2. The general name of the preparation and the source from which it is derived. 3. The number in the series, of the first and last section on the slide (see figs. 1–3); also the position of the microtome screw for the first and last section on the slide.

Example of a label (the label of the slide prepared in the Working Session), No. $\frac{3161}{9}$, August 21, 1884; cover 14^{mm}. 2. Transections of Necturus. 3. Sections 300–350. Microtome screw $30–32^{mm}$.

With such a label, supplemented of course by the proper kind of a catalogue, one sees at a glance the thickness of the cover and can adjust his objectives accordingly.

The exact position in the body of the sections of any slide can be determined by comparing the position of the sections as indicated by the microtome screw to a diagram of the animal or part, prepared previous to imbedding. In this way the exact distance of any part, say the heart, from any other part may be determined with the greatest certainty.

If the series is to be employed for the preparation of an enlarged model of the animal or part, it is also necessary to know the thickness of each section. The thickness recommended by Born is one-twenty-fifth of a millimeter. (Note 9.)

EXPLANATION OF FIGURES.

Fig. 1.—The arrangement and labeling of transections in series. No. $\frac{5}{3}$ indicates that this is series five, and the third slide of the series. C. .25 indicates that the cover-glass is $.25^{mm}$. thick; the microtome screw 25–24 indicates that the combined thickness of these four sections is 1^{mm}.

Fig. 2.—Arrangement, etc., of dextro-sinistral longisections. (See explanation of fig. 1.)

Fig. 3.—Arrangement, etc., of a series of dorso-ventral longisections. (See explanation of fig. 1.)

NOTE 1.—For a convenient vessel for infiltration see the *Medical Student*, Vol. i., p. 16; *Journal Royal Mic. Soc.*, 1884, p. 314.

NOTE 2.—In case a small animal like a young Necturus or tadpole is to be infiltrated, it facilitates the infiltration to have a small opening made in the abdomen.

NOTE 3.—For a convenient section flattener see *The Microscope*, Feb., 1884; *American Naturalist*, xviii., p. 1178; *Jour. Royal Mic. Soc.*, 1884, p. 315.

NOTE 4.—For a full discussion of the position of figures and objects see Prof. Wilder, New York *Medical Journal*, Aug. 2, 1884, p. 113.

NOTE 5.—It is best to trim away the imbedding mass so that only enough remains to support the tissue properly. If the imbedding mass is all left, fewer sections can be put on a slide and the sections cannot be made as thin as when the mass is mostly cut away. In removing it, the upper end is sharpened very bluntly as in sharpening a lead pencil, only of course the tissue is not uncovered anywhere except on the top.

NOTE 6.—The imbedding mass sometimes shrinks so that it is not firm in the well of the microtome. It may be made very firm by crowding a thin wedge between it and the well of the microtome. This must of course be forced down occasionally so that the knife may not come in contact with it.

NOTE 7.—The simplest method of transferring sections from the knife to the slide is to employ fine, curved forceps without serrations. The lower arm of the forceps should also be sharp so that it may be pushed under the section easily. If the sections are small it is best to put the slide on ruled paper, so that the sections may be got in straight rows.

NOTE 8.—If desired, the collodion and clove-oil need not be mixed, but the collodion-slides may be coated with the collodion at any time, and then when the slides are to be used a slight coat of clove oil is brushed over the collodionized surface. Gage & Smith "Serial Microscopic Sections"; the *Medical Student*, 1884, p. 14.

NOTE 9.—For a full discussion of the preparation of models from a series of microscopical sections see G. Born, *Die Plattenmodellirmethode Archiv für Mikroscopische Anatomie*, 1833, p. 584; also *American Naturalist*, 1884, p. 446.